# JOURNAL

VOLUME 8 NUMBER 5 • OCTOBER, 1952

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# JOURNAL

Vol. 8 October, 1952 No. 8

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## INDEX

### ARTICLES


Adhesion Between Layers of Different Polymers—K. Thinius ..... 7

Successful Designing for Plastics Molding—W. M. Halliday ..... 9

Vacuum Metallizing in the Plastics Industry—J. Gordon Seiter ..... 12


### FEATURES


Plastics Around the World ..... 19

The Injection Molderscope—A. R. Morse ..... 14

Ninth Annual SPE Conference ..... 4


### SECTION NEWS


Reports of the Section Activities ..... 15


### ADVERTISERS


Bakelite Co., Div. of Union Carbide & Carbon Corp. ..... 6

Barrier-Pribble & Co., Inc. ..... 23

Injection Molder's Supply Co. ..... 3, 24

Manco Products ..... 23

Metalmasters, Inc. ..... 2

Metasap Chemical Co. ..... 5

Sterling, Inc. ..... 24

Watson-Stillman ..... 4


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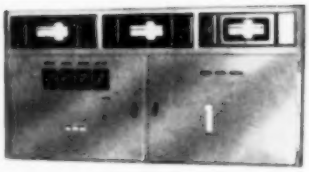

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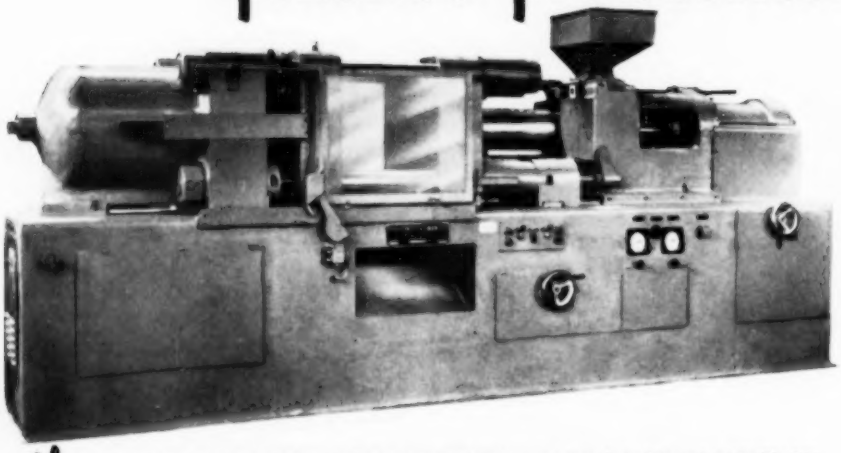

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5. The average number of copies of each issue of this publication sold or distributed, through the mails and otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semi-weekly, and triweekly newspapers only.) ———

Jesse H. Day, Editor, SPE Journal.

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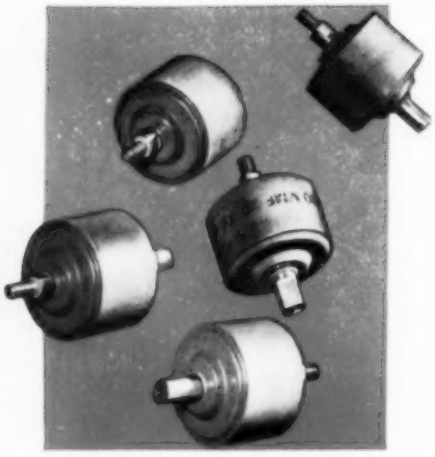

The insulating jackets on these high-voltage capacitors are molded of **BAKELITE Low-Loss Phenolic BM-17748.** They must withstand high temperatures and voltages, have low leakage and low power factor.

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SPE JOURNAL • Volume 8 • Number 8 • October, 1952

# Adhesion Between Layers of Different Polymers

By K. Thinius*

translated by: J. H. Adams
*Hercules Powder Co.*
*Wilmington, Delaware*

IN THE CEMENTING of plastics and the protection of surfaces, it is often necessary to cause two layers of different highly polymerized substances to adhere to one another indissolubly. In many cases the polymers require an additional coat of another film-former.

It has been generally believed that the adherence of a macro-molecular film-former to a substratum is better the greater the wetting action of the solvent mixture used to dissolve the film-former. For the special case of the union of layers of two film-formers with each other, a common solvent for the two different film-formers was chosen. The common solvent can be used alone or in adequately large amounts in the solution from which the top layer is to be formed.

**Use of Joint Solvents**

When a gelatin layer is to be attached to nitrocellulose, generally a crude film, solvents or swelling agents for nitro-cellulose are usually incorporated in the solution of gelatin. This principle is also used in the attachment of gelatin to cellulose triacetate surfaces. In this case an intermediate film of gelatin and a little cellulose triacetate, prepared from a solution of these two film-formers in aqueous mixtures of methylene chloride and alcohol, effects attachment of the actual photosensitive gelatin layer to the triacetate. It has also been proposed to omit cellulose triacetate and apply solutions of gelatin and chrome alum in specially adjusted solvent mixtures.

The use of a mutual solvent involves the disadvantage that the marked dissolving effect of the solvent modifies the structure of the film in a certain surface zone above the other surface.

The tendency of all vinyl polymerizates to retain solvents for a long time has an especially unfavorable effect when such highly active solvents, which often have low volatility, are used. As these residual solvents act as temporary plasticizers, they lower the tensile strength of the films or layers — often without any marked increase in elongation. Very often, it cannot be predicted what change will occur in the ratio of plastic to elastic elongation. In the case of vinyl polymers, solvent retention also always results in a depression of the softening point.

**Effects Due to Polarity**

In spite of the use of a common solvent, the adherence of two layers of different film-formers does not always satisfy practical requirements when the highly polymerized substances have different polarities. This is the case with the two technically important film-formers, polyvinyl chloride and nitrocellulose. The difference in polarity causes repulsion between the layers. The case is the same in the system composed of polar film formers and non-polar high polymers, e.g., polar-nitrocellulose cannot be made to adhere to the nonpolar polyisobutylene, the nonpolar polystyrene or polyvinylcarbazol. The same is true of attempts to bring about adherence between layers of polyisobutylene and polymerized vinyl chloride. In both cases, the lacquer film of the polar high-polymers is easily detached from the layers of the nonpolar film-formers.

**Compensation of Different Polarities**

The present studies have shown that, while overcoming these drawbacks, practically every kind of film-former can be made to adhere to one of different nature if (1) the difference in polarity of two high-polymers is compensated by the interposition of substances which combine this difference in polarity in their molecules, or (2) by compensating the difference in polarity by the interposition of substances whose molecules contain, in addition to a polar group, a nonpolar group of greater radical weight than that of the polar group.

Compensation of the differing polarities of two high-polymers which are to be adhered is generally effected by the use of mixed polymerizates prepared from at least two monomers of different polarity. Especially suitable are mixed polymerizates of vinyl chloride with monomers whose molecules contain an ether or an ester group. The only requisite is that the last-named component constitute at least 25%, generally 40-60%, of the mixed polymerizate. Vinyl chloride may be replaced by an entirely nonpolar monomer, e.g., styrene (1).

**Application of the Principle**

As is known, synthetic leathers prepared from plasticized polyvinyl chloride have a considerable capacity for water-absorption. To eliminate this drawback and to obtain special decorative effects on the surface, such synthetic leathers may be coated with film-formers which are much less permeable to water and water vapor, e.g., layers of nitrocellulose. To this end, it is merely necessary to apply the above-mentioned principle of the compensation of differences in polarity between polyvinyl chloride and nitrocellulose.

**Heteropolar Interlayers**

Linear polycondensates of polyamide type have great chemical stability to alkalies and solvents, but not to acids. In order to do away with this limitation of the field of application of objects made from polyamides, it is necessary to treat them in the same way as metals with anticorrosion agents which have been found effective for the latter. The differing polar properties of polyamides, on one hand, and of the basic anticorrosion agents (Igelit PCU, Vinoflex PC, Bunelit, Pergut), on the other hand, again call for the application of the above-described principle of polarity-compensation.

Compositions suitable for the preparation of adhesive interlayers are the mix-polymerizates of 75% vinyl chloride plus 25% isobutyl vinyl ether, 54% vinyl chloride plus 46% vinyl acetate, and a trimeric 12:66:22 mix-polymerizate of styrene, acrylic acid ester and vinyl ether. While these mix-polymerizates were at first applied as solutions in organic solvents, and a certain swelling-effect on the substratum thus was partly responsible for the excellent adhesion,

**Condensed from "Kunststoffe" 37 March (1947) and printed by special permission of that magazine.*

later studies have shown that such mechanical action on the surface could be entirely dispensed with. Using aqueous emulsions of the mix-polymerizates which were mostly obtained as the primary product, excellent adherence resulted.

In many cases, it may be advantageous to apply the high-polymer of opposite polarity in a common solution or emulsion simultaneously with the mix-polymerizate that effects adhesion.

### Polar-Nonpolar Interlayers

Suitable (2) for the compensation of polarity by substances with a polar group and a nonpolar radical of greater molecular weight than the polar group are polymerization-products, polymerizates, and mix-polymerizates of monomers of base-formulas:

$$CH_2{:}C(R)COOR_1 \quad \text{and} \quad CH_2{:}C(R)O.C.R_1$$

$$\text{I.} \qquad\qquad \text{II.}$$

where R=H or an alkyl, and $R_1$ is a nonpolar radical of greater molecular weight than that of the CO group. An example of a compound of formula I is heptyl acrylate; an example of a compound of formula II is vinyl heptylcarboxylate.

It is impossible to effect firm adherence of the polar film-formers nitrocellulose, ethyl cellulose or cellulose triacetate to layers of the nonpolar materials polyisobutylene, polystyrene or polyvinylcarbazole. Nor can layers of polyisobutylene be firmly attached to polymerization-products, although the polarity of the latter is due to other groups than in the case of nitrocellulose. If, however, we apply to the adhering surface of a coating material prepared with a dispersion of polyisobutylene, first, a solution of polyvinyl isoheptylate or the mix-polymerizate of this monomer with 40% vinyl acetate and, after drying, a nitro synthetic leather composition, these layers are firmly attached.

The solubility of the products of polymerization of vinyl isoheptylate is such that butyl acetate must be used as solvent. This is a nonsolvent for polyisobutylene. Nevertheless, excellent adhesion of layers of the polar mix-polymerizate and the nonpolar polyisobutylene is obtained.

### Dipole Moment

This result also shows the correctness of the assumption that it makes no difference whether or not a common solvent is used to bring about the mutual adhesion of layers of two different sorts of film-formers. The only thing of importance is that the polarities be compensated. The adhesion is produced, not by the solvent which evaporates, but by the atoms or atom groups responsible for the dipole moment of a molecule. For the filiform molecules of highly polymerized compounds, the dipole potential is naturally very small. The cohesion of macromolecules is due both to primary valence forces and to van der Waals forces. The latter, the values of which are determined by molecular cohesion or by the increments thereof characteristic of each atom group, act not only in the plane of the film-former from one molecule-chain to another but also outwards from this plane, especially toward the substratum.

This radiation toward the substratum will be greater the greater the increment of molecular cohesion of the characteristic group of the filiform molecule.

For macromolecules, which contain only methylene or methyne groups whose increments have the minimal values of 990 and 380 cal./mol., respectively, the secondary valence forces in the plane of the film-former will be exhausted by their action from one molecule-chain to another. The radiation is also slight when the macromolecule contains methyl groups or ether-oxygen with increments of 1780 and 1630 cal./mol., respectively. This explains the fact that adhesion with polyvinyl isobutyl ether is never strong and that separation from every substratum takes place with thread-formation. Much better results are obtained with macromolecules in which the increments of the polar groups are more than 5000 cal./mol. This shows why nitrocellulose, in which the nitro group has the large increment of 7200 cal./mol., has found such extensive use in the protection of surfaces, as an adhesive and as auxiliary layer for attachment.

### Adhesion and Swelling Effect

It is also obvious that the adhesion between two film-formers will be greater in the case of macromolecules whose increments have high values. Thus, the attachment of polyamide layers, where the CONH group has the highest known increment of 16,200 cal./mol., to nitrocellulose layers is very good. The same is true of the attachment of polyamide or nitrocellulose to polymethacrylic acid or ester, where the increment of the COOH group is 8970 cal./mol. and that of the ester group is 6230 cal./mol. However, the small increment of C (3400 cal./mol.) is not enough to make possible any effect outside of the plane of the polyvinyl chloride macromolecule. Consequently, a lacquer prepared from after-chlorinated polyvinyl chloride will not adhere to polyisobutylene.

A foil prepared from a commercial mix-polyamide of hexamethylenediaminoadipate and E-caprolactam, on swelling in ethyl acetate or its mixtures with alcohol for 12 days, shows a weight-increase of only 3% without any appreciable change in the dimensions of the foil. The foil then received five coats of a plasticized solution of a high-viscosity alcohol-soluble nitrocellulose (such as is used in the manufacture of artificial leather), pigmented with 100% zinc white, the solvent was a 1:2 mixture of alcohol and ethyl acetate. Such a mixture has no solvating action on polyamide and may be termed an especially effective precipitant. Nevertheless, the adhesion is absolutely fast, and the properties of the resultant double layer are noteworthy.

The new method employing precipitants for the polyamide as solvents for nitrocellulose produces a considerable improvement in the elongation of the two-layer foil.

### Combinations with Phenol Resins

The application of these considerations on the significance of molecular cohesion for the mutual attachment of two film-formers has made it possible to effect the permanent adherence of a layer of nitrocellulose to layers or surfaces of **hardened** phenol-aldehyde resins. This is made possible by the high increment of the amide group in polyamides. Polyamides are added to the solution of nitrocellulose and/or phenol resin, or a layer of polyamide is placed between layers of these two macromolecular substances.

In coating technique, it is no longer necessary to use, as base or top coat, phenol-formaldehyde resins having compositions that are compatible with nitrocellulose. The nitrocellulose layers are then applied after extensive or complete hardening of the polyamide-containing layers of phenol-aldehyde resin. If, inversely, the polyamide is added to the nitrocellulose solution, the proportions should be such that the phenol resin is in excess of the polyamide. The keeping properties of the phenol resin solution are generally improved greatly by the addition of polyamide. The properties of the phenol resin layers are also considerably improved by the admixed polyamide, which, moreover, makes possible the use of plasticizers.

### Summary

As the result of taking into consideration the polarity of a macromolecule and the increment of the molecular cohesion of its characteristic group, it becomes possible to effect the mutual adhesion of layers of different film-formers. The use of common (mutual) solvents — hitherto regarded as necessary — for those film-formers, while a valuable expedient, has been found to be one that can be dispensed with.

### References

(1) German Patents 713,988 (5/27/37-11/19/41); 717,672 (4/28/38-2/19/42).
German Applications D 90,711 IVc (5/12/43); D 91,142 IVc (7/3/43); D 91,735 IVa (9/30/43).
(2) German Application D 93,847 IVd (8/19/44).
(3) German Application D 92,090 IVc (11/11/43).

# Successful Designing For Plastics Molding

W. M. Halliday

*Proper attention to determination of the mold parting line can do much to speed production and save costs.*

THE most satisfactory location of flash lines upon the surface of a proposed molded component is a question very often of the greatest importance, which the designer will have to decide before finalizing the design form of the projected component.

With both compression and injection molded components some degree of flash will be caused usually in the form of a raised fin, whose thickness will vary according to the quality of the molding tool.

### Effects of Flash

Flash formed on the **external** sides of a component will prove deleterious, either in respect of the obvious detraction in the quality of surface finish arising therefrom, or because additional operations and expense will be incurred in the removal and trimming of such flashes, after the part has left the mold.

Flashings of an excessive scale which are formed on the sides of injection-molded components may also incur considerable delay and difficulty during the actual molding, particularly in regard to the extraction of the cores, and the ejection of the finished article from the mold cavity. Flash of this kind may cause the component to hang in the cavity, or to adhere too stringently to core plugs, thereby slowing down the operation of the mold.

Even though it may prove easily possible to remove flashings from a component, a slight scar generally remains, this being visible as an unsightly surface blemish on the side of the molding. The thicker the flash, the greater the tendency towards such scar formation. Thick flash is also more difficult to remove and generally will require a special die. On the other hand, very thin flash, e.g., not exceeding .003 in., may sometimes be removed without the use of the trimming tool, merely by tumbling in a small revolving barrel. With this method considerable quantities of small moldings may be de-flashed at the same time.

It has to be borne in mind that all plastics molds have to be made in at least two parts, often many more. This is required because the toolmaker must be afforded proper access to the main elements of the mold when producing the cavity formations, and later in order that the finished moldings can be readily extracted.

The main members of the molding tool, therefore, have to be matched together on what is known as the parting-line, and some marking or slight flash coincident with these jointed surfaces will unavoidably be produced on the sides of the component.

If a molded component has to fulfill mainly a decorative or ornamental function, the attainment of which requires an external surface free from all blemish or disfigurement, the determination of the mold parting will assume the greatest importance, and, indeed may actually become the overriding factor governing the design form to be employed.

Molded components, too, have very often to be produced having certain dimensions to be held within precision limits of error or variation. Undesirable variations in sizes may often accrue as a result of injudicious location of mold parting-lines. Sometimes, however, the design forms stipulated on the component will render it impossible for the designer to make the best selection of parting location in the mold to preserve dimensional accuracy in the above way.

The disposition of the parting-line in the mold, whilst in the main determined by the type of molded component to be produced, will have a considerable influence upon the complexity or otherwise of the general design of the molding tool.

Similarly, the economical operation of the mold may be influenced in no small measure by the type and location of parting-line which can be employed. For instance, if the mold has to be made with an **irregular** kind of parting-line, involving the sealage of the main blocks in two or more planes, not only will the cost of the tool be increased, but its speed of operation may be affected. Thus arising directly out of this factor, the unit cost of the moldings themselves may be increased.

These latter requirements will often arise in the most acute form with injection moldings, in so far as the incorrect or unsatisfactory determination of parting-line in the mold, may give rise to numerous operation snags, chiefly concerned with the ejection of the components in a safe, economical, and rapid manner.

The location and form of parting-line used in an injection-type mold will also exert some influence upon the runner system which may be employed. Usually runner channels and gates leading from the sprue to the cavity have to be machined in one or both the parting line surfaces. If this surface is irregular, or of some other awkward shape, it may prove difficult for the toolmaker to locate the runners and gates in the best position for feeding the cavity.

In view, therefore, of the critical relationship existing between the disposition of the mold parting-line and the flash lines reproduced on the component, it will be logical for the designer to consider carefully how the resulting unavoidable flash lines, can be minimized or disposed on relatively unimportant surfaces. In addition, he must consider how such flashings can best be removed, by the simplest trimming tools or methods and, of course, at the lowest practicable cost. To this end it will be necessary to limit the number of parting-lines in the mold as stringently as possible. For preference only one should be used.

The parting-line or lines in the mold should lie along straight, flat surfaces, or alternatively to follow the simplest geometrical shapes. Wherever possible it will be advisable to locate the parting-line to conform with an edge of the component being molded, or upon a suitably raised projection thereon.

This type of location, whilst producing a flash, does at least ensure that it can be removed expeditiously and inexpensively. Moreover, if the flash lies at an extreme edge of the component it will be possible usually to remove it without inflicting damage upon the remainder of the surface, as would be likely to occur if the flash were to be situated well back from the edge, for instance.

Endeavours should be made to avoid introducing slides, cores, and slide-guide-ways, or similar movable members, in such a manner that these intersect into the cavity formation. With such movable elements it will be impossible to ensure an absolutely tight sealing fit between them and the mold block, and as a result, should these project right into the cavity, additional flashing will be bound to occur by the interstices permitted on the joints.

### Examples of Parting-line Location

Referring to the illustrations, two views are depicted (Fig. 1), of a simple molded component which basically is a very commonly used shape.

The first view at A shows this rectangular box component, from which it should be particularly noted that the external sides are not perfectly flat and at right angles to the base

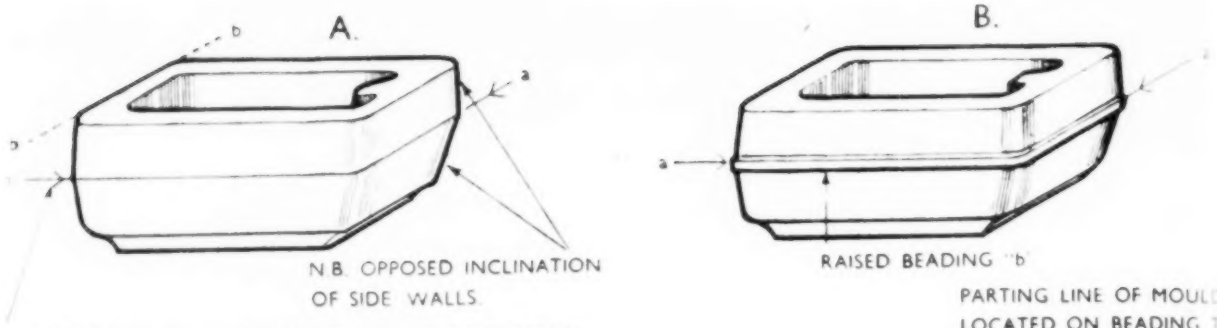
A.
B.
N.B. OPPOSED INCLINATION OF SIDE WALLS
RAISED BEADING "b"
MOULD PARTING LYING ACROSS PLAIN FLAT SURFACES WILL CAUSE FLASH REMOVAL PROBLEMS ON FINISHED MOULDED ARTICLE
PARTING LINE OF MOULD LOCATED ON BEADING TO SIMPLIFY FLASH REMOVAL

**Fig. 1.—Two designs for a simple moulded component.**

or top edges. Instead, all the sides are inclined for half their height back from the transverse centre of the part, or, in other words, from the line "a—a." This requirement entails splitting the injection molding tool along that line "a—a," in order that the part can be extracted from the mold, which feature of course could not be parted along the top edge of the article as denoted by the light broken line "b—b."

This component design would issue from the mold with a flashing around the four sides coincident with the line "a—a." Moreover, the runner and gate would be joined to this portion in the case of an injection molding, since these elements would have to be machined in the parting-line surface of the mold block.

Should a component of this type be made in a thermosetting material by compression molding, the mold would be parted along line "a—a" as before, thus giving rise to the creation of a flash line at that point of the component surface. Care would have to be taken when loading and operating the mold to ensure that such flash be kept to a minimum thickness because of the necessity to keep the resulting scar as small as possible.

This parting-line location is not to be recommended, because it will prove somewhat difficult to remove the flashings without inflicting some damage to the smoothly polished surfaces of the component.

A much more satisfactory design form is shown at B (Fig. 1). This depicts the same box molding which has been slightly modified in external shape so as to simplify the removal of flash. This modification consists of the provision of a simple beading "b" formed to project a slight amount above the general level of the component wall at the point indicated. This beading is extended across all the four sides of the part.

The parting-line of the mold is situated at the top edge of this beading as denoted by line "a—a." The shape of beading employed is of trapezoidal form having a flat crest. If desired, however, a semi-spherical shape of beading may be employed, which, incidentally, would probably give superior surface appearance to the part. If a beading of this latter shape were to be adopted, however, it would be necessary to locate the mold parting-line "a—a" so that it would lie on the crest of the curved portion exactly central with the width of the beading.

The use of a beading of this common shape will also entail rather more tooling during the manufacture of the mold, because it will be necessary to machine half of the beading section, in reverse form, into each mold block, at their parting line surfaces.

Considerable care would have to be taken when performing this operation, owing to the fact that a critical matching-up requirement will arise to ensure that each portion of the beading is truly aligned with the other when the mold is closed.

Provision of beadings of this character will usually be more simple and economically accomplished, however, because full access will be afforded to the toolmaker when reproducing these portions of the cavity, since an enlargement of the mouth of the cavity in one or both blocks, at the parting-line surface will be the only additional tooling required.

Not only will the presence of such a beading allow the flash thereon to be much more easily removed by a trimming die, shaving tool, or similar means, but any slight scar remaining will not be as prominently visible, as is the case with the preceding example shown at A.

In practice, the use of external beadings for the purpose of locating flash lines, and hiding resultant markings the better, is often resorted to by mold designers in those circumstances where some latitude is permitted them to modify the component design.

### Irregular Flash Lines

The illustrations given at Fig. 2 indicate the numerous disadvantageous features surrounding the adoption of irregular or awkwardly disposed flash lines on a component and similarly difficult parting-lines in a mold.

The first example, shown at A, depicts a somewhat unusual type of molding design, of a hollow component, which has to be molded closed at the botom (straight) side. The upper (open) end, however, is of rather a complicated shape, comprising two short flat portions, at different heights from the base, and interposed between these portions is a curved part of substantial radius and length. Two small steps, one inclined and the other perfectly square, are also to be provided where the curved portion joins to the highest flat on the end of the molding.

The mold would have to be parted along the line "a—a," whose lay-out would coincide with the above-mentioned different contours. An irregular or uneven parting-line of this character will be rather difficult to reproduce in the mold. Its manufacture would certainly entail a considerable increase in machining, tooling and fitting, because it will be essential to ensure a close seal throughout these irregular surfaces in the respective blocks. Thus the cost of a mold of this nature would be very greatly increased.

Flashing would be formed on the end of the molded article along the line "a—a." The effective removal of such flash would require an intricate trimming tool comprising a punch and die, the moldings being pushed through the latter. This die would have an opening conforming accurately to the outline of the molding along line "a—a," and of itself this tool would be expensive to manufacture.

Unless such a die possessed great accuracy there would be a danger of eventually snipping off the sharp corner of the wall when the flash was removed. This would be particularly prone to occur if the flash were of undue thickness, or the trimming tool had become worn on its cutting edges.

Furthermore, the greatest care would have to be observed when making such a trimming die to obviate scoring or marking the plain sides of the molding when passing it through the die opening. It would be neces-

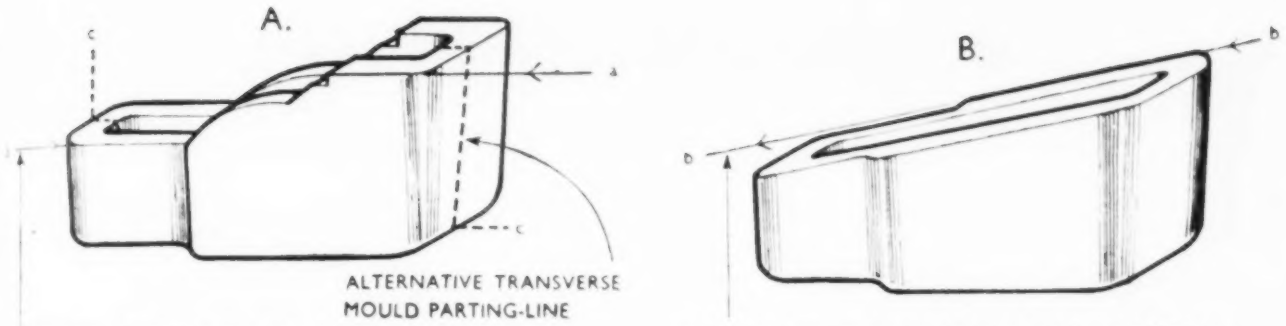
A.
B.
ALTERNATIVE TRANSVERSE
MOULD PARTING-LINE
IRREGULAR STEPPED PARTING-LINE DIFFICULT TO
PRODUCE IN MOULD FLASHING ALONG THIS
LINE ALSO DIFFICULT TO REMOVE ON PART
WITH THIS COMPONENT DESIGN PARTING- LINE "b-b"
INCLINED BUT PERFECTLY REGULAR AND STRAIGHT
FLASH EASILY REMOVED

**Fig. 2.—Disadvantageous features of irregular or awkwardly disposed flash lines.**

sary to provide a considerable degree of draft or taper on the sides of the component, to ensure that the portions below the line "a—a" would pass freely into the die opening.

The modified component design form depicted at B (Fig. 2) is a much superior and simpler shape, and the above-mentioned production and mold manufacturing snags would not arise.

With this design form it will be seen that the irregular upper edge has been completely eliminated, being substituted for a plain inclined edge, which is perfectly flat. In the first place the task of mold manufacture, and especially the questions of matching up the two mold blocks for sealing, will be considerably simplified. It will be obvious that the tasks of the toolmaker when machining a pair of blocks having a parting-line lying in a single inclined plane as shown at "b—b" will be immeasurably simpler than with the previous example.

The flashings formed along line "b—b" may be removed without passing the component through a shaving die at all. By simply applying the part to a moving sanding belt of the endless type, for finishing the top inclined edge of the part, such flashings will be very quickly removed.

The sharp corner at the junction of the vertical walls and the inclined top edge would be maintained in a very accurate manner. No damage or disfigurement would be inflicted upon the surfaces of the vertical sides of the component because trimming by the usual tool or die methods would be entirely obviated.

The savings effected in the initial cost of mold manufacture would also prove considerable in comparison with those involved in the reproduction of a molding design form of the kind shown at A.

Irregular or difficult parting-lines in a mold should, therefore, always be very carefully considered before a final selection is made, and mold manufacture is commenced. If possible the component shape should be modified to achieve the greatest simplification of the mold parting, and the location of any flash at the most accessible point.

There would be no advantage gained by employing a beading in connection with the design shown at A, since the degree of irregularity in shape would in no wise be diminished, and the toolmaker would still have to machine the necessary cavity formations with the closest precision to produce an accurate match and close seal. A beading could, however, be much more easily introduced in the case of the example shown at B, and an improvement in the general appearance of the component would undoubtedly be effected.

It would, of course, be feasible, for the mold designer to reproduce a component shape as depicted at A in another manner, by disposing the mold parting-line transversely around the top edge, after the fashion denoted by the heavy broken line "c—c." Should this be adopted, however, a cavity formation equivalent to half the component shape would be required in each mold block. A very accurate matching-up operation would thus be created when aligning the respective stepped or irregular shaped portions of the mold.

In addition, the flashings occurring on the finished component would lie along the line "c—c," extending in fact across the centre of the base and along the middle of each vertical end-face of the component. It would be practically impossible to remove such flashings without leaving some slight markings on the side of the component to detract from its appearance. The risks of scoring or otherwise disfiguring the surfaces of the remaining portions of the wall, at each side of the line "c—c," would also be greatly increased.

A component planned along these lines would, of course, have to be trimmed in a shaving die, and again due care would have to be constantly exercised by the operator when placing components into position prior to shaving off the flash. Should a component inadvertently be located out of line in this shaving die it may be found that a wider and deeper cut will be taken at one side than the other, and a portion of the flash might remain on one side, whilst an excessive amount of stock would be removed from the opposite side.

With such a mold parting-line layout, considerable difficulties would be occasioned respecting the location and operation of the core plug necessary for the formation of the hollow internal configuration in the part. Unlike the case with the mold designs for producing components of the previously explained character, this core plug could not be fixed within one mold block, and the component ejected therefrom after the mold blocks have been parted in the normal manner. This core plug would have to be movable, by being carried in a slide for instance.

This core plug would also have to be withdrawn from the cavity area before the mold blocks could be opened. Such a requirement would undoubtedly incur a longer operating cycle with either a compression or injection molding tool, and therefore operating costs would be increased in contrast to those attending the use of a simpler form of mold design previously mentioned.

From these considerations it will be evident how vitally important it is for the mold designer to make a wise selection of parting-line disposition, shape, etc., to facilitate which he should be accorded the maximum degree of discretion respecting modification of the component design and shape, so that the simplest forms can be chosen.

The advantages to be derived from a simple type of mold parting are many and extremely valuable, and are chiefly connected with reduced manufacturing costs, quicker removal of flashings, and improved appearance of the components.

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# VACUUM METALLIZING

J. Gordon Seiter

*Manager, Vacuum Metallizing Department*
*F. J. Stokes Machine Company*

THE CURRENT and growing interest of compression molders, injection molders and fabricators of plastics, in the vacuum metallizing of plastics products is becoming a trend, if not a tide.

The improved efficiency of vacuum pumping systems and the development of modern lacquers have simplified some of the formidable problems which confronted earlier technicians in vacuum metallizing work.

The principles of vacuum metallizing are easily described. Objects to be metallized—for example, low-cost plastic pieces for costume jewelry—are arranged on racks and spiders and sealed in a vacuum chamber. A high vacuum is drawn. Aluminum staples suspended on braided tungsten wire are raised by heavy current past the melting-point to the point of evaporation. As the metallic molecules are freed from the parent metal they travel off through the vacuum in straight lines and deposit themselves as an extremely thin film of glistening metal on the objects to be metallized. The latter are then removed from the chamber, lacquered for protection of the thin metal film, and dyed to the desired color. This can be gold, red, blue, amber or one of the many other hues.

Pieces can be coated on one side only, coated all over by the use of rotating racks, or continuously coated on rolls.

This is the process in its simplest terms; there are, of course, other details. Many plastics must be exhausted of absorbed or contained gases. This is sometimes done in a vacuum chamber separate from the metallizing chamber. Oftentimes a lacquer undercoat is applied. This minimizes out-gassing and levels over small surface defects which would otherwise be reproduced with perfect fidelity. Reproduction of surface characteristics is an advantage in some uses, as for example, in the metallizing of wax patterns of phonograph records, for which reproduction must be perfect. After metallizing, these are electroplated to get the necessary weight and strength. As non-conductors, the wax patterns could not be electroplated at all.

Vacumm metallizer, 48-inch diameter, with control board. Inside length 60 inches. Equipped with two 14-inch diffusion pumps, a 6-inch Microjet booster pump, a Microvac 235 cfm roughing and fore pump, and a holding pump. Courtesy F. J. Stokes Machine Co.

## COATINGS VERY THIN

Vacuum metallized coatings are extremely thin, usually one to 10 millionths of an inch. They are good against tarnishing but will not tolerate abrasion. If the piece is to be handled in service the topcoat of lacquer affords the necessary protection to the metal beneath. They are highly reflective when deposited to opacity (usually about three millionths). This makes them valuable in finishing plastic materials which might otherwise be scrapped for color. Vacuum metallized coatings are fully flexible on acetate sheets. When flexed, the brilliant luster disappears from the surface but reappears immediately the sheet returns to normal. Moisture vapor transmission is greatly reduced—often to as low as 0.5 mg per square inch per 24 hours—so that vacuum-metallized plastic sheets are suitable for moisture-proof packing. The brilliant luster of these metal coatings is achieved without buffing or other hand finishing. The cost, amortization of equipment included, is far below that of electroplating or silver reduction.

# in the Plastics Industry . . . . . .

Quoted costs for vacuum metallizing vary from the rule-of-thumb figure of 1c per square inch for separate pieces to 1c per square foot for roll-coating paper. A typical comparison of the cost of metal coating 1000 pieces of a decorative item by three well-known methods is as follows:

| | |
|---|---|
| By electroplating . . . . . | $14.00 |
| By silver reduction . . . . . | 7.00 |
| By vacuum metallizing . . . . | 3.00 |

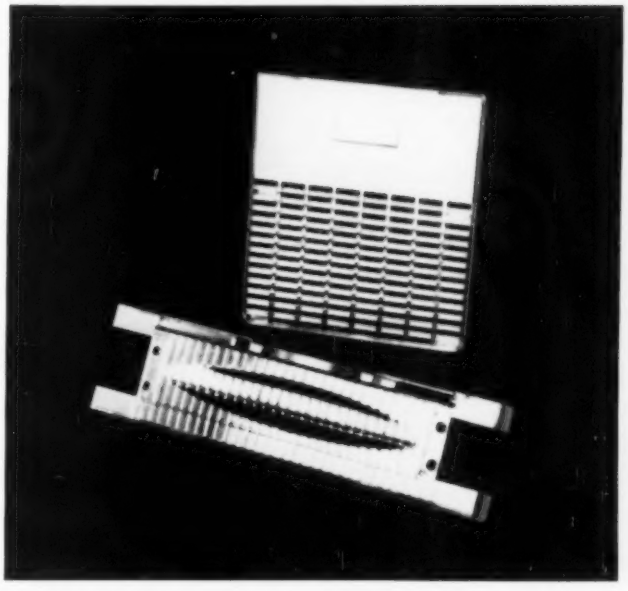
Compression molders use vacuum metallizing on radio housings, buttons, reflectors for many kinds of lights, handles, knobs, light-switch shields and appliance parts. Injection molders use it for automobile parts, costume jewelry, toys, Christmas tree ornaments, insignia and name-plates. In plastics fabrication, vacuum metallizing finds use in acetate and cellulose sheeting, plastic boxes, store displays and plaques. And the list grows day by day. An unusually interesting application of vacuum metallizing is seen in many name-plates, especially of automobiles and electrical equipment. In this use, known as "second-surface" coating, the clear plastic part is molded with the name on the under side. Part of this side is masked and the metal deposited on the letters of the name. The back is then lacquered for protection and painted for opacity. From the face the name appears as if in solid metal letters seen through glass.

While there are numerous firms specializing in custom vacuum metallizing there are also many custom molders and plastics manufacturers who are using the process with great success. Standards of efficiency in modern high vacuum equipment, such as shown in adjacent pictures, are such that ordinary engineering and manufacturing skills are adequate for day-in and day-out operation. The work is so simple that ordinary factory help can be trained to handle it in an hour or so. After lacquering and baking, the metallizing itself is merely a matter of opening and closing valves in the proper order and at the proper time; when the correct vacuum is shown by the gage, power is switched on and evaporation takes place in a few seconds; then vacuum is broken and the material removed.

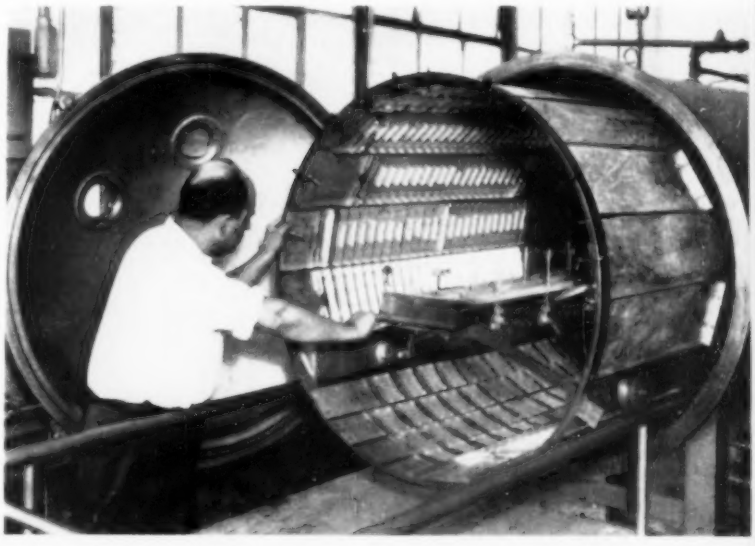
## COST OF INSTALLATION

Investment runs from $35,000 up for substantial production facilities, though a thoroughly efficient installation for semi-production work or small runs can be set up for $10,000 to $12,000. Floor space requirement is 2000 to 4000 square feet for basic equipment including lacquering and baking facilities. The limiting factor in vacuum metallizing is the abrasion which the metallized object will suffer. Even lacquered objects will not stand up indefinitely under sustained abrasion. Costume jewelry, molded drawer pulls and light switch shields are entirely satisfactory; handles for knives and forks would not have satisfactory life in service.

Despite the low labor cost and low material cost, the low unit cost compared with other metal coating processes obviously depends on a substantial production demand. But the ever-growing use of plastics, many of which must simulate the metal they replace, seems to be an adequate guarantee for the future of vacuum metallizing in the plastics industry.



Grill and top of radio cabinet made for a nationally known manufacturer by Worcester Moulded Plastics Company. Parts are given a brilliant silver appearance by vacuum metallizing with aluminum.



Radio cabinet parts entering vacuum chamber to be metallized with aluminum. This chamber is arranged for one-side coating. Racks protect inside of chamber and are easily cleaned of deposit. Tungsten filaments, with aluminum hooks to be vaporized, can be seen above and below center of chamber. The metallized parts, lacquered for protection, have the brilliant appearance of polished silver.

# THE *Injection* MOLDERSCOPE

By A. R. Morse

*President, Injection Molder's Supply Co.*

## How to make a million dollars!

AS ONE looks at the sample cabinets of various injection molders, it is amazing how many really good ideas are found stored there that never got into real production. These parts tell an instructive story that every successful injection molder has to learn sooner or later: good distribution is the injection molder's best key to success. The story of these molded parts usually begins with some creative individual originating the idea for a product, often a very good one. For a specific example, let me refer to a broad-based, covered, non-spillable baby tumbler I saw recently at Trump Plastics in Cuyahoga Falls, Ohio. The product was undeniably a wonderful idea, and the molder had done an excellent job of perfecting the design for injection molding. It seems impossible to believe that any young mother would do without such an indispensable item.

As my old friend Elno Trump and I admiringly looked at the molded cup, I could not help but think of all the dozens and dozens of other times I had seen fine, useful products get to the same stage this one had reached, and then never materialize into the best seller it seemed so plainly to be. The one thing these inventors, idea men, (and injection molders) have always overlooked is the tremendous cost of setting up a "one-shot" distribution system to get volume sales on one isolated injection molded product. If such a product involves an expenditure of say $10,000 to ready it up for production, it will take (as a scrimpy guess) 3 or 4 times THAT investment to even begin to promote it successfully. Too many times the inventor fails to realize that the world no longer beats the path to the door of the man with the better mouse trap. Things have changed. The public is blase. Store shelves are crowded with good ideas, and even the BEST new item today costs a young fortune to promote its sale.

The fact still remains, however, that lying in dozens of injection molders' sample cabinets are countless dusty items that are still good, salable products, but which failed to bring the inventor his money back and the molder a bang up molding job because only one think was lacking: **good distribution through proper channels!** You could make a million dollars if you got hold of some of these items and knew where and how to establish sales outlets for them so the deserved volume could materialize. And you would not have to spend a penny for molds either—just strike a deal with the molder, inventor or owner!

(In this connection I might mention one of the oldest pitfalls in injection molding: the molder becomes so taken with the obvious worth of a custom job that he is led into figuring a price based on an expected volume of production **before** it materializes. What runs he does make are at a loss because they are too short, and the long runs may never arrive for lack of one thing: **good distribution.**)

## "IT'S YOUR MONEY"

IT'S YOUR MONEY is an invaluable survey published by The Dow Chemical Co. Midland, Mich. and available from them on request. The booklet shows comparative earnings and sales figures of our industry—I say **our** industry because the emphasis is mainly on injection molders.

The survey was run off by Tarnell Co. 350 Fifth Ave. New York 1, New York, who specialize in the analysis and rating of plastic molding companies with particular reference to injection molders. (Since most big material suppliers subscribe to and support Tarnell it is almost more important to the injection molder to file his detailed statements with Tarnell than with Dun & Bradstreet. Certainly this confidential information is a good deal more restricted in its circulation there, as Tarnell subscribers are strictly limited to those concerns with an interest in the plastic molding business.)

At any rate, every injection molder should write for a copy of **"It's Your Money."** You will see a revealing breakdown of our industry's sales figures. The value of the survey is increased because it reflects how a business of about your own size has been performing, and gives a useful yardstick to measure yourself and your costs by. Like all expanding, growing business, the injection molder has a plainly lower net profit figure than established comparative businesses like paint or rubber. I will not try to sum up this material as I cannot do it justice, except to say that the tax bite seems to hurt a small business worse than a big one. Hats off to aggressive, sales-minded Dow Chemical Co. for their sponsorship of this important survey!

### A Starved-weighed Feeder

When dapper super-salesman Jim Currie of Glengarry Processes, Inc., Bay Shore, Long Island, New York rolls impressively into town in his big new green Cadillac, you can be the injection molder will soon be hearing from him!

His story is well worth listening to because Glengarry Processes have a gram feeder which is just about perfect for starved-weighed feeding of injection molding machines. Jack Brecker of Louis Marx Plastic Division claims a remarkable 5-7% savings in piece-weight on virtually all molds when using weighed feed, and bringing the plunger all the way home. Startups are facilitated, scrap is reduced, rejects cut. Indeed the only thing now that makes me wonder a little about the mad rush to get a feed weigher on every injection machine is the fact that there does not seem to be a single argument against it!

The Glengarry Feeder is rugged, simple, foolproof. It was adapted from a food and pharmaceutical weigher, and pioneered by the injection molding department of American Hard Rubber Co. in Butler, New Jersey. It was given the blessing of the eminent injection molding pioneer A. J. Desimone of the A. J. Desimone Co. Paterson, N. J., and it is already installed on or ordered for 100 machines in the Erie area alone. This feeder may well be the answer which the injection molder has long sought to molding problems resulting from injection machine feed irregularities caused by the present so-called proportional feeders.

Glengarry expects to be in full production on the feeder by the time this appears, and it looks like we can just about say goodby to all our molding problems that can be traced to the traditional "cushion" we have long run ahead of the plunger. The Glengarry unit sells for around $700, and completely replaces the conventional hopper and feed mechanism. The injection molder must install it himself with simple legs or standards so it will dump its weighed charge directly into the feed chute. A simple limit switch or time delay is needed with a delay of 1-10 seconds to give the feed bucket time to empty. Various size buckets are used on various size machines, and the filling rate of the bucket can be set to any cycle or any size shot. Adjustment for changes in weight and cleaning are very easy. The unit is made throughout of stainless steel. With the appearance of this fine, sensitive, yet rugged weigher, I guess we can just about say Amen to starved-weighed feeding for the time being at least. The Glengarry unit is definitely superior to the volume-weigh and scale weigh machines we built—but at any rate I have a nice copy-right on the term **Starv-Way Injection Machine Feeder!**

# SECTION NEWS

*Edited by*
Stanley Bindman

## TUMBLE FINISHING OF MOLDED PLASTIC PARTS IS DESCRIBED AT SOUTHERN CAL.

Robert L. Whann

With the aid of illustrations, models, plastic parts, finishing compounds and a sample tumbling barrel, Mr. R. T. Barnes, Jr., Equipment and Supplies for Western Industry, San Carlos, Calif., discussed the "Tumb-L-Matic" processes for tumble-finishing equipment, compounds and techniques for automatically deburring, cutting, smoothing and lustering molded plastic parts.

In basic principle the tumble finishing of plastics is a relatively simple operation, consisting only of tumbling or rolling the molded parts one against the other, in the presence of abrasive compounds and carriers. In actual practice, however, a successful tumbling operation requires a great deal of care in the proper selection of equipment, compounds, carriers, and in the determination of the correct time cycles.

The advantages of tumble finishing over hand methods are many. Most appealing perhaps is economy, and tumbling may cut finishing costs in half or more. Tumble finishing is completely automatic, and independent of the operator's skill. Thus it also makes for uniformity, with each subsequent lot of parts having the identical degree of finish. Tumbling is ideally geared for mass production methods. Space requirements likewise are much less.

All the popular plastics are amenable to finishing by tumbling. With compression molded and cast parts, tumbling may be used to remove flash, and develop final finish. With certain injection molded pieces tumbling can be utilized to remove flash most efficiently. In tumbling, the only actual limitation comes with size of the piece since larger, heavier parts require special handling. There is no special limit on smaller pieces, and beads can be finished successfully only by this method.

There are two important tumbling processes—the wet and the dry. Wet tumbling, in the presence of water, is not indicated for plastics because it is so difficult to clean the parts after. The dry process was developed primarily for plastics finishing. This takes place in several steps, all dependent on the degree of finish required, and the complexity of the part itself. Usual first operation is a definning, in an open mesh barrel, and with no added carrier or compounds. Ashing and smoothing, in separate steps are carried out in wood-lined metal barrels, with suitable abrasive compounds and carriers, and for specific time cycles. Lustering, or waxing, is final operation when desired, and can be accomplished with a cream in place of wax.

R. T. Barnes, Jr.

Tumbling barrels are available in a wide variety of types and sizes. Most modern have an overhead gear drive, with single or double compartments, frequently in a multiple-tier arrangement to accommodate more tumblers in smaller space, and with screen to provide quick and efficient separation of carrier and work. Tumbler sizes may vary from 21"x 20" to 30"x36", with the larger the more popular.

The charge to the tumbler, except for a simple definning operation, will include the correct ratios (by volume) of work, compounds, and carriers. There is no general ratio adaptable to all types of plastic and shapes and sizes of part, but each is best determined by actual trial. A common ratio for medium-sized phenolic moldings might be one part wood balls, two parts wood pegs, and two parts work, with several ounces of compound. With plastics the preferred carriers are round maple balls, or wood pegs in varying diameters and lengths. Compounds are usually a dry powdery abrasive for ashing, and abrasive creams of different grades for smoothing and lustering.

In tumbling, whether it be plastics or metals, the speed of the tumbler is most important. For plastics, an average tumbler speed of 35 rpm is common, with larger parts tumbled somewhat slower, and smaller tougher ones a little faster—sometimes to as much as 70 rpm. Once the optimum speed is found for a part it should be strictly adhered to.

The length of the tumbling cycle varies considerably for each material, and for each step. Definning, for example, may take from a few minutes to as much as eight hours. Ashing and smoothing may require up to 16 hours, depending on the degree of finish required, and the complexity of the part. Lustering may take several hours, and is usually determined by frequent inspection.

Loading of the barrel is especially important, and overloading can slow or even ruin the work. Best loading is to about 1" below the center line of the tumbler. The experienced operator can tell from the sound of the tumbling barrel in operation whether or not conditions are right.

The ideal method for determining correct ratios of work and carriers, compounds, speeds, and time required consists in having small samples of the work tumbled on pilot-plant scale before any actual production cycles are established. By this means the best of hand-finished parts can be duplicated exactly, with a minimum of time loss, and without the necessity of experimenting on full production lots.

Tumble finishing has many other interesting applications apart from plastics. It is very widely used in the finishing of small, mass-produced metal parts, and in preparation for plating. It is used in the incorporation of color concentrates in batches of neutral colored plastics, and in the application of paints to certain wood articles. It is useful in the burnishing of silver and tableware in hotels and restaurants, and in the finishing of both soft and hard rubber articles.

# THOMAS E. ORR AWARDS MADE BY CLEVELAND—AKRON SPE

*The Thomas E. Orr memorial Award is made annually to two outstanding students in plastics, one at Akron University, and one at Case Institute of Technology. The award is a year's membership in SPE.*

Claude P. Alexander

Frank Martin (left) presents a Thomas E. Orr award to Marvin Diesz of Akron University

## Cleveland

The Thomas E. Orr award was made to Claude P. Alexander and the actual presentation to Mr. Alexander was made by Professor G. W. Blum in one of the last class periods in the course in "Advanced Technology of High Polymers."

By vote of the faculty of the Department of Chemistry and Chemical Engineering, Mr. Alexander was selected to receive this first Thomas E. Orr award of membership in the Society of Plastics Engineers. The basis for the choice of Mr. Alexander was his excellent scholastic record, interest in the plastics field and experience in the field.

Claude P. Alexander was born June 1, 1929 in Oleon, Missouri. He graduated from Cuyahoga Falls, Ohio High School in 1946. He then attended Case as an undergraduate receiving the degree of Bachelor of Science in Industrial Chemistry in June, 1950. Since graduation Alexander has been employed as a development engineer at the Goodrich Chemical Company plant in Avon Lake, Ohio.

In order to augment his training Alexander has been taking evening division courses in the graduate division of Case since his graduation. The major emphasis of his training has been in plastics and high polymer chemistry in general. His plan is to take his graduate work in chemical engineering and therefore he has been taking course work in this field.

Mr. Alexander has just now resigned from his position at the Goodrich Chemical Company in order that he be able to return to Case as a Research Assistant on an Army Ordnance sponsored research project in Mastic Materials. This will enable him to pursue his graduate work more actively.

## Akron

Marvin A. Deisz is a senior in chemistry at Akron University this year. He plans to go on for his master's degree in rubber chemistry. After school, he works as a technician in the research laboratories of General Tire and Rubber Co. here in Akron.

Mr. Deisz is a World War II veteran having served in Europe with a combat engineer division and having participated in the invasion in southern France. He is a native Akronite, is 27, married and has two children, a boy 7 years and a girl 2 months.

# BUFFALO SECTION HEARS DISCUSSION OF PLASTICS IN BUSINESS MACHINES

R. H. Rushmer

The monthly meeting of the Buffalo Section of the Society of Plastics Engineers was held at the Hotel Sheraton, Buffalo on Friday, September 19, 1952.

The dinner meeting was a Smorgasbord attended by a large group of members and guests.

The meeting was devoted to a talk and question period conducted by Mr. Frank W. Reynolds, Manager of the Plastics Research Laboratory of International Business Machine Corporation, Endicott, New York. Mr. Reynolds, a member of the Rochester Section as well as a company and voting member of SPI, presented an outstanding discussion of the applications of plastics in the products of his company. Mr. Reynolds' talk showed a keen awarness of the characteristics of both thermosetting and thermoplastic materials. He covered specific cases of the use of phenolics, ureas, high pressure phenolic laminates, and low pressure polyester-fiberglass in the thermosetting field and cellulose acetate butyrate, methyl methacrylate, vinyl, and nylon in the thermoplastic field.

The nature of the use to which plastics are put in these products demands extreme precision, a minimum of dimensional change due to temperature and humidity variations and a maximum wear life. IBM is now using at least 17 different plastic materials which are fulfilling these requirements.

Mr. Reynolds stated that there are four independent factors related to the satisfactory molded item. They are:

1. Good part design.
2. Correct material choice.
3. Proper type of mold and mold design.
4. Experienced molding technique.

A violation of any of these will result in an unsatisfactory part. Adherence to all will be well rewarded.

**November 21**

**Our next meeting is November 21**

"Marking of Plastics & Plastic Products"

A. N. Skeels
Roll Leaf Stamping Co.
Union City, N. J.

## COLOR FACTS GIVEN AT CONNECTICUT

### David Mersey

September 12 marked the first 1952-53 meeting for the Connecticut Section.

We were presented a splendid program, called, "Color Facts and Fantasies" by the Calco Division of American Cyanamid Company. It sent a four man team comprised of Drs. E. I. Stearns and R. Coleman, and Messrs. F. J. Hines and C. B. Robinson.

Of all the stories and remarks passed around that night, the one best fitting the occasion was the line by Confucius, or maybe Sidney Smith wrote, "one picture is better than a thousand words."

The program opened with a demonstration and explanation of the various chromatic colors, and a breakdown into hue, tone, and value. Hue refers to the dye or pigment used, as, red, yellow, blue, etc. Tone means the modification of the hue by the admixture of white, grey, or black; the whites becoming tints, the blacks shades. Value is the relative lightness or darkness. This was demonstrated by the use of a 'color block,' with white and black at opposite poles, and the chromatic colors running through the middle axis.

Dr. Stearns then explained, and Dr. Coleman projected on the screen, the additive and subtractive systems of color mixing. An example of the additive system is the addition of blue to red to produce violet. Whereas, the subtractive system might be shown by the filtering of blue from violet to leave red. This was followed by a showing of several fluorescent color combinations, and how they are affected by ultra-violet light. The balance of the program was spent showing the application of color as an aid to better merchandising, and as the basis for good interior decorating and industrial design.

The program was intended to show all the ramifications of color, something we generally take for granted. It did that and more. This was one program that had to be seen to be appreciated.

## VINYL DISPERSIONS ROCHESTER TOPIC

### E. W. Goral

The Rochester Section meeting, held at the Clintonaire Restaurant on Monday evening, September 15, 1952, had as their guest speaker, Mr. E. B. Slaght of The Stanley Chemical Co., East Berlin, Connecticut. The subject matter pertained to "Vinyl Dispersions for Molding and Dipping" and covered such ingredients as vinyl resin, plasticizer, stabilizer and colorant which make up materials known to the industry as plastisols, organosols, and plastigels.

Since one characteristic of plastisols is that they will start to set up at around 200°F, slush molding of baby doll heads was easily demonstrated. A preheated mold was filled with flesh-colored plastisol and allowed to stand for a length of time until the heat penetrated to the required depth corresponding to the desired wall thickness. When the necessary length of time passed, the mold was emptied and placed in an oven for the final high temperature fusing which takes place instantaneously at between 350°F and 375°F. The mold is then removed and the temperature of the plastisol allowed to cool down to about 160°F which is cool enough so that the doll head will not distort when pulled from the mold, and warm enough so that it is flexible enough to collapse easily for removal.

A dipping process was also demonstrated in coating of small tool handles, such as pliers and wire cutters, with a brilliant red non-drip plastisol which is then fused at 350°-375°F.

Various items on display such as ladies' boots, dish drainers, plating racks, tumbling barrels, candy molds, and circuit breakers stimulated interesting discussions on increased uses for vinyl dispersions.

## ST. LOUIS TALK IS ON SILICONES

### C. D. Kacalieff

Dr. Kenneth R. Hoffman of the Dow-Corning Corporation presented a comprehensive review of "Silicone Resins" at the first fall meeting of the St. Louis section of the SPE. Dr. Hoffman outlined the chemistry of the silicones and discussed its uses and fabrication. The talk was well illustrated with slides and numerous sample parts. Dr. Hoffman was in St. Louis in conjunction with the Dow-Corning silicone exhibit at the Hotel Chase. The exhibit was attended by many of the local section members who saw what was perhaps one of the most dynamic presentations of a new product and its uses. A wide variety of silicone products were on display and were undergoing extreme tests of temperature variation, chemical resistance, and mechanical abuse.

It was reported that the next meeting in October will feature Mr. Ken Craver of the Monsanto Chemical Co. who will report on his recent trip to Europe.

The St. Louis section is now enjoying the most rapid growth of its existence with 28 new members reported so far this year.

## NEW YORK HAS ANNUAL GRIPE MEET

### A. M. Merrill

The New York Section began the new season with its annual business meeting and "gripe session" on September 17 at the Gotham Hotel. Some 45 members and guests attended the meeting which included a cocktail hour and dinner, followed by a showing of the Bakelite Co. sound-color film, "Fight to the Future."

Section president Bruno E. Wessinger, Wess Plastic Molds, Inc., presided over the business session at which reports were given by the various committee chairmen. Harold Schwartz, Empire Brushes, Inc., reported on the progress of the educational program being carried on in conjunction with the New York City Board of Education, and aimed at establishing a plastics vocational high school. There was also a discussion of topics for future meeting programs, and many suggestions were made to program chairman Irving Rubin, Robinson Plastics Co. Plans for the Section's annual Christmas party are already under way, with Saul Blitz, Noma Electric Co., in charge of arrangements for the second year.

Table favors in the form of Ronson repair kits were distributed through the courtesy of Guy Martinelli, Sylvan Plastics, Inc., and the meeting closed with a drawing for three door prizes contributed by Empire Brushes.

The next meeting of the New York Section was held on October 15 at the Gotham Hotel. The technical session featured a symposium on mold engineering and design factors, including their relation to costs, by two speakers.

## SOUTHEASTERN OHIO TALKS ON WEATHER

### Paul M. Smith

The Southeastern Ohio Section of the Society of Plastics Engineers held their regular meeting Sept. 26 at The Berwick Pioneer Room in Cambridge, Ohio. Meeting was opened by the President and it was decided to have a combination of technical and non-technical meetings this year.

The temporary program chairman Mr. Jack Knight introduced the speaker Prof. Murdock of Muskingum College who gave an interesting discussion on meteorology covering the formation of clouds and the movement of high and low pressure areas. The meeting was closed by the president and a buffett lunch was served.

## N. W. PENN NOTES

### Paul Roche

Kenneth Erwin has completed his tour of active duty with the United States Army and is now enthusiastically back on the job in the lab at The General Electric Co. in Erie. It is understood from an unofficial source that Kenny is specializing in thermosetting plastics and that our other SPE member, Arnold Varner, is holding down the thermoplastic end.

Dick Hydeman has applied for SPE membership in the Northwestern Pennsylvania section. As previously reported, Dick has been at Nosco Plastics since last Thanksgiving time and is in charge of vacuum-forming development, having come by way of Dow Chemical Co.

Jim Quinn, Quinn Berry Corp., is in the process of leaving on a European trip on the new liner "United States," accompanied by the Mrs. (Business and pleasure, the Erie Times says—that ought to square everything). He will look in on the Quinns in the old country, naturally.

We note that Harry T. (Bud) Farnstrom is about to move into a new ranch-type home in West Erie. In the mold shop "Farnstrom & Son," Bud holds the position of son. We understand that Harry L. (the old man) designed the attractive home, so all Bud has to do is pay for it.

## PLASTIC PIPE TOPIC AT EAST NEW ENGLAND

### M. S. Haas

The fourth dinner meeting of the Eastern New England Section of SPE and the Boston-Providence Section of SPI, was held at the Hotel Beaconsfield, Boston, Mass., on Thursday evening, September 25, 1952.

Jim Lang introduced Mr. Robert Montell of the New York office of SPI. Mr. Montell spoke briefly on the importance of the subject of the evening and referred to a press release of SPI on the subject of "Plastics Pipe Research Program."

The secretary and treasurer's reports were read and accepted. The treasurer's report showed a balance of $599.78, as of Sept. 1, 1952.

Mr. Lang announced that we now have 82 active members and spoke on the problem of delinquent members. He also briefly discussed the tentative program of the year.

Mr. John LaBelle spoke on the progress being made on the SPE Convention. He announced that General Doriot was obtained as the Keynote speaker. John Moore then introduced the speaker of the evening, Mr. John Marvin of the Tennessee Eastman Corp. Colored movies were shown of Australia and the Use of Butyrate Pipes in Australia, followed by a talk by Mr. Marvin, subject, "Plastic Pipe, A Growing Field."

## DETROIT TOPIC IS VACUUM METALLIZING

### Emil R. Gazdick

The Detroit Section of the SPE held a dinner meeting at the Rackham Memorial Building on September 19, 1952.

Mr. T. C. Comer, field manager of Distillation Products Industries, Division of Eastman Kodak Company, gave an extremely interesting talk on the subject of "High Vacuum Metallizing."

Mr. Comer began his talk with an explanation of high vacuum, where it is used, how it is produced, why and where it is used. He followed this with a description and explanation of the equipment used in vacuum metallizing, and the process of the high vacuum metallizing of plastics and metal formed parts, such as die casting, stamping, etc.

Slides were shown of the type of equipment which can be used for pre and past lacquering of high vacuum metallizing articles.

Mr. J. E. Swope, technical representative of Distillation Products, alternated with Mr. Comer in answering numerous questions during the question and answer period.

Announcement is made of two new members to the board of directors. M. Herzina, president of Mold-A-Matic Company and F. Berdan of Dupont will fill the vacancies created by the resignation of C. White and W. Kosey. Along with these additions to our board of directors Mr. E. Erickson of Detroit Plastic Products has been elected secretary.

Jack Totten of the Ford Motor Company has recently been promoted to the position of technical assistant to the plant manager. His new responsibility broadly embraces the improvement of quality and more efficient production of plastic parts.

The yearly golf meeting of the Detroit Section was held August 5, 1952 at the Forest Lake Country Club.

## "EYES OF FLIGHT" AT GOLDEN GATE

### V. C. Rollins

On September 25 the Golden Gate Chapter of the Society of Plastic Engineers enjoyed Fabricators' Night at which Mr. Ernest Smyth, of Rohm and Haas Company, presented the film "Eyes of Flight" and gave a very excellent talk covering the historical background and growth of its acrylic plastic sheet known as Plexiglass.

President Akers presided at the meeting and introduced guests which included Mr. Rothrock, General Sales Manager of Rohm and Haas, who spoke for a few minutes on the growth of the nation as a whole. He then introduced the speaker Mr. Smyth, who pointed out the many wide fields of application into which Plexiglass goes — not the least of which has been in the development of signs, both illuminated and non-illuminated, which range in beauty and attractiveness to the standard regular type from the spectacular. He pointed out that this development occurred right here on the West Coast, and he predicted a very great future for this product in this and many other applications wherein plastic can do a better job than former materials. Sixty-seven people were in attendance at this very interesting meeting.

## CHICAGO SEES FLIGHT TO FUTURE

### M. A. Self

Mr. V. E. Serrell of Bakelite Company introduced the film "Flight to the Future" at the September 17 meeting of the Chicago Chapter of SPE-SPI. The film presented an interesting portrayal of the development of various plastics and their many uses, along with a projection of ideas of what plastic is to bring in the future.

"Flight to the Future" is available through the courtesy of the Bakelite Company. It is not the usual "commentary" type of picture but gets across its message by means of a story vehicle. The action takes place in a chartered airplane which makes stops on its transcontinental flight to pick up four principal characters representing four phases of the plastics business. These are a manufacturer, an engineer, a designer and a "patriarch" who symbolizes the cumulative experience of the entire industry. A pretty young airlines stewardess acts as the foil for these four characters as each tells his part of the story of plastics. The result is an informative and memorable half hour that will leave a lasting impression on the SPE-SPI audience.

The September meeting marked the first joint SPE-SPI meeting in the new quarters at the North Park Hotel located at 1931 Lincoln Park West in Chicago. Visitors are cordially invited to join the Chicago Chapter in the meetings on the second Wednesday of the month throughout the winter at the above address.

**(More Section News on page 22)**

# AROUND THE WORLD

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## AUSTRALIA

**Abstracter: Albert Lightbody**

*Australian Plastics*, Vol. 8, No. 82, May 1952

**P.V.C. Cinema Screens:** Staff Article

Comparison of P.V.C. cinema screens with other types now in use are made. The advantages of the P.V.C. screen are (1) higher brilliancy factor, (2) can be washed down and (3) can be used in open-air cinemas.

**Plastics Report from Britain:** W. S. Penn, B.Sc.

Difficulties in marketing have caused several plastics plants in Britain to lay off men. Increase in production has brought consumption of benzene to over 16,000 tons per annum in 1950, with annual production of polystyrene to 136,000 tons, polyethylene to 40,000 tons and nylon fibre to 55,000 tons. New developments include "Cobex," a rigid vinyl copolymer; a continuous process for protecting printed papers by cellulose acetate film; and a new extender and filler, "Franvinyl," for P.V.C. claimed to improve strength and wear properties. New British patents cover such items as preservation of transparency in cellophane packages, reduction of plasticizer migration in food packaging, and reproduction of rods, tubes, etc. from polytetrafluorethylene. A new book on "Linear Polymers" is announced.

**A Proposal for Establishing Certified Injection Moulding Machine Specifications:** David J. Sloane

S.P.E. prize-winning paper reprinted from S.P.E. Journal.

**Fundamental Considerations In the Injection Moulding of Polystyrene:** G. W. Cheney

Part I. This article covers sprue, runner and gate design and the balancing of gates on multiple cavity molds.

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## GERMANY

*Kunststoffe*

**Abstracter: Anne Schwend**

The July 1952 issue of the "Kunststoffe" magazine contains articles on the following subjects:

1. Dr. Engineer Walter Burkart of Karlsruhe reports about deflashing of both compression and injection molded parts in scrubbing drums, different grinding methods, polishing methods as well as dip polishing of artificial horn in hypochloride lye stabilized with alkali, a chemical procedure for polishing molded parts in contrast to the mechanical methods.

2. Dr. Engineer Hans Friedrich Mueller of Stuttgart publishes the results of his investigations regarding the influence on the composition of phenolic molding compounds by changes in the production and processing and the fluctuations observed in the properties of these resins. In order to gain knowledge of the relationship between production and composition of phenolic resins on one hand and the properties of phenolic molding compounds on the other hand, resin fractions and various types of resins were processed with the help of uniform fillers. The results obtained during molding as well as upon investigation of the molded parts are enumerated.

Differences in the effectiveness of molding compounds are based on differences in the resinous structure which in turn is directed by the conditions prevailing during condensation of the resins. It is not only a question of taking into consideration the well-known difference between novolaks and resolic resins, but tests with fraction-resins (having different molecular percentage of resinous bodies) do show that even within one and the same type of resins the internal composition may be subjected to changes which are of decisive influence on the properties of the molding compounds. The attitude and reaction of resins of the same type are defined by the average molecular weight, solubility and the meltability of the resinous bodies as well as their degree of distribution.

The results of these investigations lead to believe that molding compound resins should not show too great differences in the properties of its components, but rather complete meltability and solubility of the individual ingredients forming the resin at possibly homogeneous composition. Unfavorable results are obtained in the presence of non-transformed basic materials as well as resinous bodies condensed too much and unmeltable.

Further, the spatial structure of the resinous bodies is of importance for curing. This becomes especially obvious when comparing the novolak curing of resins on the basis of phenolics, m-cresol and 1,3,5-Xylenol. While phenolic novolaks do offer favorable conditions for the absorption of the curatives due to their chainlike structure, the curing process is spatially impeded with the cresol novolaks and particularly with the Xylenol novolaks, so that considerable differences in the curing speed as well as the strength of the molded parts are to be noticed.

Aside from the physical properties and the spatial structure of the resinous shares a third factor, the condensation speed, is added for the resolic resins. The curing speed of resolic resins, for instance, is considerably increased when using Xylenol instead of phenolics for the production of resins.

The next article is a resume of news from the British Industries Fair in 1952.

W. Laeis discusses how considerable simplification and price reduction in the building of organs can be achieved by arranging a valve underneath each pipe which is operated directly from the key through an electric impulse. These valves consist of a shell-like casing with two openings at the base through which air may enter. At the bottom the valves are connected with a coil having a metal pin inside with a conical sealing cone which a spiral spring is pressing against the upper opening so that entry of air is impeded. Giving an electric impulse to the wire wound around the coil will automatically pull downward the sealing cone, thus permitting entry of air through the

valve openings to the pipe for that length of time that the key is pressed down. The valve bodies are injection molded of polystyrene, the valve linings made of polyethylene.

Dr. Hansjuergen Saechtling of Troisdorf explains that the Plastics Exhibition of 1952 to be held at Duesseldorf in October shall center around a special show on the usage of plastics in everyday's life, demonstrating the properties of plastics, testing and standardization methods, application of plastics in the technical field, use in office and apartment rooms (bathroom, playroom for children, kitchen, garden), in restaurants, in the jewelry trade, leatherware and textile fields.

Anton Schmidt of Ludwigshafen reviews the correct processing of polystyrene, best molding temperatures, designing of molded parts and injection cycles.

For those plastic molders who do not possess a laboratory nor the necessary means for conducting tests at temperatures from -158°F to +32°F there are listed different chemicals that will give the required cool temperatures when mixed with ground ice. A chart shows chemicals and maximum freeze temperatures obtainable.

A new German patent accorded Mr. Otto Zollfrank of Erkersreuth, patent No. DBP 833.118 dated December 12, 1951, now makes it possible to insert a plastic foil into an impact mold and to form the molded part in such a manner that it will enter rigid and durable connection with the foil. This same process which has been known for a long time in the production of laminated materials, has now been applied also in the processing of thermoplastics.

New publications by German firms:

Farbenfabriken Bayer, Chemical Sales Department, Leverkusen:

1. Polyesters for casting and low pressure molding—field of application,—processing methods for types 356 L. and 356 L. for cold hardening and 291a, PM 23 and PM 52 for hot hardening.
2. Silicones Bayer I. 15 and Bayer I. 21. Properties and processing methods, flexural strength and splitting load of glass cloth molding compounds dependent on ageing time at +356°F.
3. KS binder — an organo-silicatic binder free of alkali for moldings of asbestos the mineralisation of which is caused by thermal or hydrolytic dissociation.

Badische Anilin- und Sodafabrik, Ludwigshafen Rhein.:

1. BASF Products for the lacquer industry—Short analysis of raw materials and expedients for the lacquer industry and related industries.
2. Plastomoll WH. An aliphatic dicarboxylic acid ester plasticizer for molding compounds, (PVC, polyvinylacetate, dispersions).

Bakelite GmbH., Letmathe i.W.:

1. "Karbamidharz-Pressmassen" — Processing methods and properties of the new carbamide resins type 131.
2. Bakelite — More than 50 pages illustrating the production program of the Bakelite Gesellschaft mbH., Letmathe i.W.

Chemische Werke Huels, Marl, Kreis Recklinghausen:

1. Vestolit — Short description of various polyvinylchloride types, their main properties and processing methods.
2. Vestolit Pastes — Detailed pamphlet showing production, properties, processing and application of PVC pastes for coating, dipping, spraying and foaming.
3. "Vestinol AH und Vestinol AH spezial" — Properties and fields of application of the company's dioctylphthalates.
4. "Vestinol C"—Data of dibutylphthalate made by Chemische Werke Huels.

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## GREAT BRITAIN

### BRITISH PLASTICS, July 1952

**Abstracter: Herbert R. Simonds**

**EDITORIAL** (1 page)

The Plastics Institute of Great Britain celebrated its 21st birthday last month.

The new president, T. L. Birrell takes over a well tried organization with a membership of 18,018. Mr. Birrell states that this membership is not commensurate with the size of the British plastics industry.

**PLASTICS FOR AUTOMOBILE BODIES** (4 pages illustrated)

The Singer S.M. 1500 sports convertible is being fitted with a glass-fibre-reinforced plastics body for sales on the American continent. The bodywork is molded, in one piece, in the United States, and fitted to chassis shipped from the United Kingdom. It is reported that car manufacturers in East Germany are making 2,000 plastics cars this year. Details of construction are not yet available.

In France a prototype of a car of revolutionary design has been built with a resin-bonded glass-cloth body. This will be known as the "Syn-tric."

In England, although development centers on the resin-bonded glass-fibre type of body, Mullineux Ltd. has built several prototype bodies on a different basis. These are molded from a paper-reinforced resin material and heat treated in an autoclave somewhat after the rubber bag technic.

Following the above is an illustrated description of the Glasspar car which was extensively publicized in the technical press in this country a few months ago. This body is being produced by the Glasspar Company of Costa Mesa, California. It is made of a combination of glass cloth and polyester resins. The resin, known as Vibrin, is produced by the Naugatuck Chemical Division of the United States Rubber Company. The glass material is produced by the Owens-Corning Company. The body is approximately 1.5 inches thick and costs from $650. to $800., depending upon the size of the chassis to which it is to be fitted. The molds are built up of wood and plaster and of course are less expensive than those for the costly custom-built body of metal.

The wood and plaster are given a coat of polyvinyl acetate which acts as a parting agent to insure that the female production mold will break away cleanly and easily.

**PVC WIRING IN TELEPHONE EXCHANGE EQUIPMENT** (5 pages illustrated)

Until recently, coverings most widely used for telephone exchange equipment have been textiles. These have certain disadvantages in modern exchange practice.

The insulation resistance varies with changes in relative humidity. Also, conductors in damp locations are liable to corrode. Attempts to introduce p.v.c. as a coating material have been met with some difficulty but one firm, Siemens Brothers & Co. Ltd. has persevered and is now successfully using p.v.c. in their equipment. The grade of p.v.c. used by the firm offers a good example of the available properties of this material. Under test, it develops a resistance value of 1,000 megohms per 1,000 yards immersed in water at 20°C after twenty-four hours immersion.

The 0.020 inch diameter and 0.05 inch diameter conductors are covered with 0.011 inch radial thickness of p.v.c.

One of the difficulties with the use of p.v.c. coating in the past concerned soldering. Heat from a soldered joint which causes p.v.c. to run back is a difficulty which has been solved partly by using high grade p.v.c. and partly by a mass-soldering technic. The soldering is of special interest.

A machine forms the wires between two adhesive rayon ribbons, so that

series of loops protrude in a specified order. The p.v.c. insulation on these loops is removed by a heat pressure system and the ribbon covered wire is then inserted over the bare points of the various loops. The wiring is pressed, forcing the loops home, and the assembly is then rotated and immersed in baths of solder. Six banks of contacts are passed through the baths at the same time and it is stated that over 14,000 connections are soldered in a few minutes. The actual solder time is four seconds.

**BUTYRATE FOR AIR FILTERS** (1 page illustrated)

The Norgren replaceable-bowl lubricator is used with air pressures up to 125 lb sq.in. and has previously been made of metal. Now, it is being successfully fabricated of cellulose acetate butyrate. These bowls are injection molded singly on a Reed Prentice 8 oz. machine by Plasticast Development, Ltd., for G. H. Grange & Co., Ltd., manufacturers of Norgren air filters.

**PLASTICS APPLICATIONS** (4 pages illustrated)

Items of interest under this subject include:

(1) A cylinder of an oil gun, making visible interior content.
(2) Extracting vessels and other parts of chemical plant.
(3) A terminal block 14 inches in diameter and 3 inches deep made of a combination of phenolic and bitumen materials.
(4) Butyrate handles for screw drivers and other tools.
(5) P.v.c. stickers — Thin pliable p.v.c. sheeting is adhesive on either side and when printed makes attractive informative stickers.
(6) Ambulance interiors are shown fitted with buff linette Formica panelling.

**UREA RESINS USED IN BRAILLE PRINTING** (3 pages illustrated)

This is an interesting article describing the many difficulties involved in developing a process for printing both sides of a paper strip with solid semi-spherical dots in the familiar braille manner. From the printers' point of view the ink had to be thixotropic to a specific degree. It had to be of a certain viscosity to enable horizontal printing in relief on both sides of a vertical plane.

The process was developed by J. Groak in conjunction with the National Institute for the Blind, London. Types of plastics tried and discarded included ethyl cellulose, isomerized rubber, akali-catalyzed phenolic resins, and finally, the successful application came through the use of a filled and plasticized urea-formaldehyde resin. Plasticizing was done with "Hercolyn," an ester of abietic acid.

**SOME OBSERVATIONS ON THE DARKENING OF COMMERCIAL TRICRESYL PHOSPHATE**

**by: E. H. Searle, and L. G. Whitlock** (3 pages, no illustrations)

Tricresyl phosphate is probably the most widely used of all plasticizers in the plastics field according to the authors. It has all-round efficiency and is most attractive, but it has a tendency to darken when heated and even when stored. It is stated that for most applications, this darkening can be overcome as suggested by the authors. The following table illustrates the work of the authors:

**TABLE 1.**
**OBSERVATIONS ON COLOR CHANGES IN TRICRESYL PHOSPHATE**

| Test | Sample A | Sample B | Sample C | Sample D |
|---|---|---|---|---|
| Color as received | Good | Good | Good | Good |
| Color after storage in partly filled clear glass bottles | Good after 2 years | Good after 6 months | Good after 6 months | Good after 6 months |
| Sp.gr. at 20°C | 1.174 | 1.164 | 1.164 | 1.177 |
| Ref. index at 20°C | 1.5573 | 1.5560 | 1.5563 | 1.5578 |
| Loss in wt. after 20 hr. over boiling water in an open dish | 0.09% Negligible darkening | 0.04% Negligible darkening | 0.04% Negligible darkening | 0.07% Negligible darkening |
| Open exposure for 20 hr. to G.E.C. white light carbon arc | Appreciable yellowing | Faint yellowing | Faint yellowing | Faint yellowing |
| Exposure in a corked tube under carbon arc | Little change after 20 hr. in an almost full tube Subsequent exposure for 20 hr. in a half-full tube gave yellowing. | Very faint yellowing after 40 hr. exposure in a half-filled tube. | As sample A, but ultimate tint less intense. | As C. |
| pH of cold aqueous extract | 3 | 3 | 4 | 3 |

**PLASTICS IN GERMAN CHEMICAL PLANT** (2 pages illustrated)

This article describes events at a recent exhibition of the German Chemical Engineering Society held in Frankfurt-on-the-Main.

Among the items of interest described are the following:

1) a new product, Hostaflon (polytrifluoro-chloroethylene), similar to the American product Kel-F.
2) A series of containers made of compressed wood with inner linings of polyethylene. These were in the form of drums and bottles. Linings varied from 0.02 to 0.05 mm. in thickness.

## PLASTICS, July 1952

**Abstracter: Alfred T. Rexer**

**LIGHT DIFFUSING PANELS:**
**J. B. Singer**

The design for day-lighting and artificial lighting in buildings is discussed. For daylighting, a good heat-retentive laminate of resin-bonded glass fibers, faced on both sides with a sheet of clear glass is described. The use of white translucent plastics in the three types of luminous ceilings is described in detail.

**MOULDING PRESSES FOR PLASTICS IN SWEDEN:**
**P. G. Nylen and H. Akerlind**
*(A reprint from "Ericsson Review," 1951, No. 4)*

A description of the new moulding department for the production of certain phenolic and melamine plastics parts required in the manufacture of telephone instruments at Telefonaktiebolaget L M Ericsson, Karlskrona, Sweden. Pictures and drawings illustrate the detailed description of the several presses for compression moulding (100 tons), transfer presses (165 and 175 tons), and presses for "inverted moulding (200-100 tons) which are used for manufacturing instrument casings, micro handles with earpiece and ring, as well as coil bobbins. The presses are equipped with instruments and control devices for semi-automatic operation and are synchronized with the high-frequency preheating units.

**GLASS FIBRE REINFORCED PLASTICS**

Abstracts of papers read before the

Glass Fibre Reinforced Plastics Convention held in England in May 1952.

**POLYVINYL ACETATE EMULSIONS:**

**A. E. Lever**

A detailed discussion of polyvinyl acetate emulsions covers the examination, compounding, and applications of these milky dispersions of resin in water. Some of the applications are heat sealing, wet bonding, coating, paints, and leather finishing.

**"TWIN-O-MATIC" 50-TON MOULDING PRESS**

A description of a moulding press, made by Jackson, Heywood & Co., England which is claimed to remove the time normally taken in unloading and loading from the total cycle time of the job. It accommodates two compression moulds side by side, the rams of which automatically alternate up and down, thus accomplishing the above time reduction.

## MASS PRODUCTION, Vol. 28, No. 3, March 1952

**Abstracter: Gerald Eisner**

**PLASTICS**

One point of interest brought out in this article is the wax polishing technique used on thermosetting plastics. This operation is performed in a tumbling barrel with wooden pegs dressed with the following wax compound:

4 oz. Stearic acid
4 oz. Spermaceti
4 oz. Paraffin wax
4 oz. Carnauba wax
4 oz. Flushing oil
2 oz. Beeswax

Sufficient turpentine to make up one gallon of the mixture.

The pegs are dressed by tumbling with the melted wax compound. (25 lbs. of pegs require approximately 4 oz. of wax).

The plastic parts are tumbled with the dressed pegs for 5 to 10 hours in an enclosed barrel ending with a ½ hour tumble using a wire mesh cover to allow the residual solvents to evaporate.

★

# HOLLAND

## PLASTICA, Vol. 5, No. 7 (1952)

**Abstracter: W. P. ter Horst**

**THE FUNCTION OF STABILIZERS IN POLYVINYLCHLORIDE:**

**P. Platzek,** pp. 206-208

The decomposition of Polyvinylchloride chains can take place twofold:

a. HCl is eliminated with formation of a double bond.

b. Oxidation takes place, especially under the influence of oxygen activated by ultraviolet light, with formation of carbonyl groups, which are strongly chromophoric. On continued heating, polyvinylchloride turns yellow, orange, brown and finally, black and simultaneously turns hard and brittle. The decomposition reaction is autocatalytic.

Stabilizers function threefold by:

a. Inactivation of the double bond.

b. Protection of the oxidizable groups.

c. Binding of the liberated HCl.

A tabulation is given of the types of chemicals that are recommended as stabilizers. There is no doubt about the excellent protection from light and heat imparted by certain organic tin salts, whereas basic lead salts protect primarily against heat and certain cadmium compounds protect primarily from light.

The technology is far ahead of the science of protection.

**PARTIAL REVIEW OF TODAY'S CELLULOSE RESEARCH:**

**P. H. Hermans,** pp. 221-225

Summary:

A review is given of the progress of research on cellulose in the last decade. The shape of the molecular chains of polymers of glucose is discussed in relation to the bed- or chair-position of the glucose-units and of the cis- or trans-connection of the successive links. The unique position of cellulose among other polymers of glucose is sketched.

Recent results of research on the biogenesis of cellulose are given. Methods to measure the contents of crystallinity are given and the signification of this quantity for the technical properties is discussed.

To be continued in the August issue.

★

# MEXICO

## MEXICAN RUBBER AND PLASTICS, Vol. XII, No. 77, June 1952

**Abstracter: John B. Ballard**

**VACUUM TECHNIQUE IN THE METALLIZATION OF PLASTICS:**

**E. Blasco Santiago and L. Miranda Montes**

The principles of vacuum metallization, and a description of experimental vacuum metallizing equipment built at the L. Torres Quevedo Institute in Madrid, Spain. Reprinted from the Plastics Review of Madrid.

**THE FIRST NATIONAL PLASTICS EXPOSITION IN SPAIN—**

**Editorial**

A report of a plastics exposition and meeting held in May 1952 in Madrid, Spain, to commemorate the second anniversary of the publication of the "Plastics Review" by the Department of Plastics of the "Patronato 'Juan de la Cierva' de Investigacion Tecnia" of Madrid.

SECTION NEWS *from page 1*

# SYNTHETIC FIBERS TORONTO TOPIC

**G. M. Hale**

Fifty years ago, mankind had four fibres to choose from to make clothing—cotton, wool, silk and linen.

Today, there are 55—and more on the way.

And the textile engineer, by carefully blending the finest and most desirable properties of any of them, may be expected to build fabrics to meet any specific need, J. L. M. Thurlow of Canadian Industries Limited told the opening meeting for the 1952-53 season of the Society of Plastic Engineers at the St. Regis Hotel tonight.

Suits which are light yet warm, crease resistant and press-retentive, he pointed out, were already on the market, and the qualities of only one of the synthetic fibres, "Dacron" polyester fibre were needed to make them so.

"Discovery of nylon by the du Pont Company in 1938 touched off an avalanche of new synthetics which hasn't yet been stemmed. Some of the fibres are still in the experimental stage; some have fallen by the wayside, and others are specialized."

Nylon had already brought great changes in the clothing industry. Other man-made fibres which are expected to make a great impact on apparel in Canada in the future are "Orlon", du Pont's acrylic fibre, "Dacron", "Dynell", "Acrilan", and "X51", Thurlow said.

"One may expect the textile engineer to combine the man-made fibres with each other, with the so-called regenerated fibres, like rayon, and the natural fibres to give us better products than we've ever known."

Malcolm Wilkinson, president of the Canadian Section of the S. P. E., announced that invitations had been sent to 600 plastics engineers in all parts of North America to attend the society's 1953 convention in Toronto.

## NEWARK ACTIVITIES

### W. J. Trautweiler

The fall season of Newark Section was opened with a welcoming address to the 80 members and guests by the President, Ed Rowan.

Professional Activities Committee Chairman, Wayne Schrag, announced that the author of the best paper submitted by any member of Newark Section only, for entry in the National S.P.E. Prize Paper Contest, would be awarded a prize of $100.00.

Don Biklin, Program Chairman, then introduced Dr. Nolan B. Sommer, as the first speaker of the evening. Mr. Sommer, who is supervisor of the New Product Development Division of American Cyanamid Company, addressed the group on the topic of "Translating Research into Profits". The speaker described the research activities of his organization and stated that the millions of dollars invested in research programs today by progressive companies, have definitely paid dividends.

The second speaker of the evening, Mr. Galion C. Fordyce, Ass't to Director of Purchases, American Cyanamid Company, presented a verbal picture of the operations of a purchasing department.

Pat LaGrutta formerly with Lapin Products has recently become affiliated with Garray Plastics of Belleville, N. J. as Vice-Pres. in charge of Injection molding. La Grutta states Garray Plastics is set up to handle the engineering, design and construction of molds through its tool-room facilities.

Ed Soules, Detroit Mold Engineering Co., announced the transfer of Robert J. Fox from the Chicago office to the Hillsdale Plant. Bob's new position is Sales Representative for D.M.E. services and supplies for the Eastern Area.

Frank Tokes, formerly with Tech-Art Plastics is now handling the tool Engineering and Sales for Wiggins Plastic Molding Co., of Belleville, N. J.

## CLEVELAND

### Frank A. Martin

Approximately 70 members and guests attended the opening fall meeting of the Cleveland Section September 29 at the Spanish Tavern in Brecksville. The program consisted of a very excellent sound film produced by the American Foundrymens Association on gating of molds. This color film, through the use of Lucite molds and high speed photography, showed the flow pattern of metal under various sprue, runners and gating conditions. Some analogies to plastics molding were evident.

On November 24 the Cleveland Section will meet at the Spanish Tavern to hear Mr. James Bailey of Plax Corporation discuss "Blow Molding".

The annual Christmas party to which all of the wives look forward will be held December 11 at the Aroura Inn. This is the final meeting under the old officers, and promises to be the highlight of the winter season.

## *Publications*

### NEW AICO PLASTICS APPLICATOR HELPS FIND RIGHT MATERIAL QUICKLY

With a host of plastics to choose from, the new AICO plastics Applicator is proving a big help in selecting the best plastic for any particular product. Its unique combination of features offers a reference system that eliminates the possibility of overlooking any important plastic when designing or specifying parts.

The disk-shaped gadget was designed by AICO engineers and gives the complete physical properties of the 15 most popular plastics. With a simple turn of its dial, the applicator automatically selects the three best plastics for a given property and numbers them in order of desirability. It also names the molding method which assures best results for the finished product.

Produced by the American Insulator Corporation of New Freedom, Pennsylvania, it is available for the asking.

### PLEXIGLAS GLAZING

A new 16-page two-color booklet gives detailed information, in text and illustration, on glazing industrial and other buildings with flat panels of the acrylic plastic Plexiglas.

The booklet is written for plant maintenance engineers, architects, and maintenance superintendents of office buildings and schools, who are confronted with frequent breakage of windows, or other glazing problems which involve high labor costs. The booklet recites properties and behavior of this plastic sheet, and gives detailed data on installation methods and methods of cleaning. Two full pages are devoted to 12 detail drawings which show how to install the shatter-resistant plastic in wood and metal sash.

Tables list percentages of solar heat and visible light transmitted, and recommended thicknesses for lights of various sizes. The booklet is available on request to the Plastics Department, Rhom & Haas Co., Washington Square, Philadelphia 5, Pa.

### RESIN EMULSION

Tackifying and reinforcing resin emulsion for both natural and synthetic rubber latex are described in a new data sheet, A-42, of American Resineous Chemicals Corporation, Peabody, Massachusetts. ARCCO Tackifiers are being used in the manufacture of dry stick adhesives where the coated film of adhesive will adhere only to itself. This feature speeds production because strong, clean bonds are made immediately upon contact. Dry stick adhesives are universally used in approximately 150 different applications in the manufacture of shoes, belt, and other leather goods.

### BEETLE

American Cyanamid Company's Plastics Department announced today the publication and availability of a new booklet, "30 More Manufacturers", which illustrates household appliances and fixtures molded of Cyanamid's BEETLE, LAMINAC and MELMAC plastics.

The booklet contains a brief description of each houseware product illustrated, pointing out the qualities which make a particular Cyanamid plastic especially suitable for that application. Names of molders or manufacturers of the various products are also included.


BARRIER-PRIBBLE & CO., INC.

554 EBEN STREET, NEW HAVEN, IND.

Wayne Pribble:

That spool job you mentioned last month was a corker, but one job I think you should tell about is the telephone base. Do you remember that the original mold when we took over had a complicated link action wedge and two side cores? And that when we got through it was a simple straight up-and-down compression job and production was doubled?

Maybe folks should KNOW about these things.

Al Barrier

JOURNAL

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# New Books

**Fundamental Principles of Polymerization** by G. F. D'Alelio. Published by John Wiley & Sons, New York. 467 pages plus index. $10.

D'Alelio says in the preface "This book is not encyclopedic in scope, but summarizes what I believe is the minimum fundamental knowledge that a scientist in the field of polymers should have." The book does a good job in presenting this knowledge.

Noteworthy are the careful and complete definitions of terms, which to now have had conflicting usage; monomer, comer, copolymer and the like.

The book is aimed primarily at the chemist, but is readable by anyone with a knowledge of organic chemistry. Primary topics covered: the structure of polymeric molecules, copolymers and their stability, and particularly good sections on the mechanisms of polymerization processes. A chapter is devoted to the kinetics of polymerization.

The opinion of the reviewer is that this book is an excellent addition to the literature, and probably will be a **must** for chemists and those responsible for the production of plastics. The book has some faults, none of them great, but which should be changed in a revised edition. Among them are: pg. 50, the word **maleic** for **maleic anhydride**; pg. 285, the term **analytical extinction coefficient** is incorrect; pg. 294, equation 15, the capital K should be lower case.

A very excellent and useful feature is the inclusion at the end of each chapter of a great number of references to the original literature. In all your reviewer counts 885 such references.

J. H. Day.

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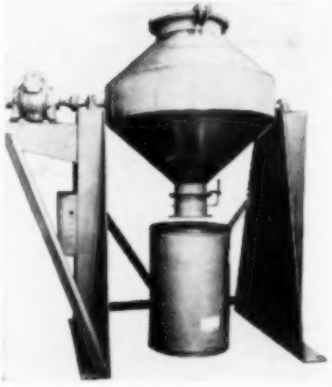

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